

MAP MF-1382-L

DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

**MAPS SHOWING DISTRIBUTION OF ANOMALIES BASED ON THE
USE OF SCORESUM PLOTS FOR SELECTED GROUPINGS OF
ELEMENTS IN SAMPLES OF MINUS-60-MESH (0.25-MM) STREAM
SEDIMENT, WALKER LAKE 1° X 2° QUADRANGLE,
CALIFORNIA AND NEVADA**

By M.A. Chaffee

MISCELLANEOUS FIELD STUDIES MAP
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CHAFFEE—ANOMALIES BASED ON SCORESUM PLOTS, STREAM SEDIMENT, WALKER LAKE 1° X 2° QUAD, CA-NV 1:250,000 MAP MF-1382-L



Base from U.S. Geological Survey, 1957; revised 1969

MAP A. DISTRIBUTION OF SITES FOR MINUS-60 MESH (0.25-MM) STREAM SEDIMENT SAMPLES WITH HIGH SCORESUM VALUES FOR THE ELEMENT SUITE: SILVER, ARSENIC, GOLD, BISMUTH, CADMIUM, COPPER, MOLYBDENUM, LEAD, ANTIMONY, TIN, TUNGSTEN, AND ZINC

SCALE 1:250,000

CONTOUR INTERVAL 200 FEET

NATIONAL GEODETIC DATUM OF 1983

Geology simplified from Stewart and others, 1982

INTRODUCTION

This report is part of a folio of maps of the Walker Lake 1° x 2° quadrangle, California and Nevada, prepared under the Continental United States Mineral Assessment Program. The folio includes geological, geochemical, and geophysical maps, as well as mineral resource assessment maps, which identify selected known or possible mineral-deposit environments in the quadrangle. The geochemical maps show the distributions of selected individual elements (Chaffee and others, 1988a, b, c, d) and the distributions of selected groups of elements (Chaffee, 1988a, b). Discussions accompanying the individual element maps are restricted to possible mineral residences of the individual elements as well as to what types of mineral deposits and environments may be represented by anomalies of a particular element. Discussions accompanying the multielement map describe the types of mineral deposits that may be related to each element group and indicate the most favorable localities for these deposits.

This chapter of the folio shows the distributions of anomalies for selected groupings of elements, resulting from a technique called SCORESUM (Chaffee, 1988). In 1,116 samples of minus-60-mesh (0.25-mm) stream sediment collected from 110 stream-sediment samples included in this report are from samples collected during 1967 and 1968 for the Inland Basin Primitive Area study (Tooker and others, 1970). The rest of the samples were collected and analyzed during 1978 and 1979, specifically for the present report. A combined tabulation of all these analyses is published as U.S. Geological Survey Open-File Report 80-881 (Chaffee and others, 1980). This same tabulation is also available on computer tape from the National Technical Information Service (McNair and others, 1981).

GENERAL GEOLOGY

The Walker Lake quadrangle includes parts of two major physiographic provinces: the Sierra Nevada-Cascade Mountains and the Basin and Range provinces. These two provinces have contrasting geological frameworks that reflect their different geologic histories. Because the geology of the Walker Lake quadrangle is complex, only a brief generalized summary is given here.

Sierra Nevada-Cascade Mountains province

Most of the western one-third of the quadrangle is in the Sierra Nevada. The Sierra Nevada includes the major Sierra Nevada batholith, which is composed of plutons ranging from Permian(?) to late Cretaceous in age (Keith and Seltz, 1981). These plutons range from alkalic to gabbro in composition. This plutonic complex is intruded and metamorphosed by a variety of Paleozoic and Mesozoic rocks that comprise both classic and carbonate-sedimentary rocks as well as volcanic (and plutonic) rocks. Overlying these older units locally are Tertiary volcanic rocks consisting of flows, breccias, and lahars, and intrusive dikes, sills, and dykes. Most of these Tertiary volcanic rocks are andesitic in composition; however, rocks of rhyolitic composition are present locally. Glacial and landslide deposits are present locally in many of the valleys in the Sierra Nevada.

Basin and Range province

Most of the eastern two-thirds of the quadrangle is in the Basin and Range physiographic province. Much of this part of the quadrangle contains thick sequences of extensively block-faulted Paleozoic and Mesozoic sedimentary rocks of widely varying compositions. Mesozoic plutons, which range in composition from alkalic to gabbro but are predominantly in the granite to granodiorite range, have intruded and locally metamorphosed the overlying sedimentary rocks. A long history of Tertiary volcanism is recorded throughout the part of the quadrangle; thick sequences of flows, breccias, and tuffs, ranging in composition from rhyolite to basalt, are found throughout much of the area. Tertiary classic sedimentary rocks were deposited in some areas. Tertiary and Quaternary volcanic flows, breccias, and shallow intrusive rocks, ranging in composition from rhyolite to basalt, are also present locally. Alluvial, lacustrine, and eolian sedimentary deposits are present in most of the valleys in this part of the quadrangle.

Geologic base for the geochemical maps

A simplified geologic base map of the Walker Lake quadrangle has been used with each of the accompanying geochemical maps. A more detailed geologic map of the quadrangle is available as a separate chapter in this Walker Lake folio (Stewart and others, 1982). For purposes of discussion in this report, some of the geologic units shown on the geologic map of Stewart and others (1982) have been consolidated into three major units.

Paleozoic and Mesozoic rocks—all of the pre-Cretaceous (Paleozoic and Mesozoic) igneous and sedimentary rock units (units Pz and Mz on map) have been consolidated into this one unit. Many but not all of these rocks have been metamorphosed.

Mesozoic intrusive rocks—Plutons ranging in composition from alkalic to gabbro compose this unit (unit Mz on map).

Tertiary volcanic rocks—This unit is composed predominantly of flow rocks of andesitic composition, but it also includes rocks and flows ranging in composition from rhyolite to basalt as well as felsic to intermediate tuffs (includes units Ts and Tt on map).

ECONOMIC GEOLOGY

The Walker Lake quadrangle contains many mines and prospects. As a result of the complex geologic history of the area, many different mineral-deposit environments exist within the quadrangle. On the basis of geological and geochemical studies conducted for the reports in this folio, as well as on the recorded mining in the region, the communities thought to have the greatest resource potential within the Walker Lake quadrangle are copper, lead, zinc, gold, silver, molybdenum, tungsten, and uranium. Thus, this discussion stresses these elements and element suites that may prove useful in locating areas containing (1) base and precious metals and tungsten

The term base metals in this report includes some or all of the elements antimony, arsenic, bismuth, cadmium, copper, lead, and zinc. The precious metals are silver and gold.

NATURE AND SCOPE OF THE GEOCHEMICAL SAMPLING

The geochemical sampling program for the Walker Lake quadrangle was based on collecting as many as three different types of samples—rock, minus-60-mesh stream sediment, and nonmagnetic heavy-mineral concentrate derived from stream sediment—at preselected locations throughout the quadrangle. Most of the samples of alluvial material were collected from first-order (unbranched) and second-order (below the junction of two first-order) stream channels as shown on 1:62,500-scale topographic maps.

The chemical analyses of the samples of stream sediment and concentrate provide information that may be used by the evaluator to separate the background concentrations of the elements discussed in this chapter of the folio from their anomalous concentrations. Anomalous concentrations may indicate the presence of as yet unknown mineral deposits that may be either exposed or buried. Plots of the analyses can be used to delineate those areas where samples have been found to contain anomalous concentrations of one or more elements commonly associated with one process.

Many anomalies shown on the accompanying maps are related to known mining activity. Some known mineral deposits are not reflected by anomalies, however, primarily because they are not close to sampled stream channels but also because not all samples collected were truly representative of the material being eroded upstream from the sample site. Because the sampling was designed and executed on a reconnaissance scale, some relatively small but exposed areas of anomalous rock may not have been detected despite proximity to sampled stream channels. Mineral deposits not exposed at the surface may not be easily detected even if part of the deposit system, such as an alteration aureole, is exposed. Additional detailed geochemical surveys would be necessary to identify and delineate specific mineralized areas.

The stream-sediment samples provide information about the elements in only a limited number of minerals. The concentrating process removes most of the quartz, feldspar, and minerals, and high specific minerals. This selective concentration of minerals commonly related to mineral deposits permits determination of some elements that are not commonly detected in stream-sediment samples by emission spectroscopy. The concentrate chemistry may also be specific for certain minerals. For example, the concentration of barium in a stream-sediment sample represents the sum of barium contained in barite plus barium contained in potassic feldspars and possibly other minerals. Because of the processing procedures used, the barium in a concentrate sample represents predominantly the single mineral barite.

DESCRIPTION OF THE SAMPLE MEDIA

Sediment was collected from active stream channels and processed to produce the minus-60-mesh stream-sediment and the nonmagnetic heavy-mineral-concentrate samples. Unlike rock samples, which represent a restricted, essentially fixed sample of the rock, stream-sediment samples are considered to represent a composite of outcrop material eroded from the entire drainage basin upstream from the collection site.

The stream-sediment samples provide information about the elements in all of the minerals present in the eroded rock materials. In contrast, the concentrate samples provide information about the elements in only a limited number of minerals. The concentrating process removes most of the quartz, feldspar, and minerals, and high specific minerals. This selective concentration of minerals commonly related to mineral deposits permits determination of some elements that are not commonly detected in stream-sediment samples by emission spectroscopy. The concentrate chemistry may also be specific for certain minerals. For example, the concentration of barium in a stream-sediment sample represents the sum of barium contained in barite plus barium contained in potassic feldspars and possibly other minerals. Because of the processing procedures used, the barium in a concentrate sample represents predominantly the single mineral barite.

SAMPLE PREPARATION AND ANALYSIS

Sample preparation

The stream-sediment samples were composited from active alluvium collected from several locations within a 50-ft (15-m) radius of the localities shown on the accompanying maps. Each resulting sample was air-dried and then sieved. The material passing a screen with 0.25-mm openings (a 60-mesh screen) was saved and pulverized.

The concentrate samples were processed from the same composited alluvium material collected for the minus-60-mesh stream-sediment samples. The material was wet-panned until most of the quartz, feldspar, organic material, and clay-sized material was removed. The samples were air-dried, and the highly magnetic material was removed using a magnet. Any light material remaining in the concentrate was then separated by allowing the concentrate to settle in water, and the supernatant liquid was decanted (specific gravity 2.86). The resulting heavy-mineral fraction was then separated into a magnetic and a relatively nonmagnetic fraction using a Franz Isodynamic Separator set at 0.6 ampere, with 15° forward and 15° side settings. The resulting nonmagnetic fraction was pulverized in an agate mortar.

Sample analysis

Both stream-sediment and nonmagnetic heavy-mineral-concentrate samples were analyzed for 31 elements (Ag, As, Au, Bi, Ba, Be, B, Br, Ca, Cd, Co, Cr, Cu, Fe, La, Mg, Mn, Mo, Ni, Pb, Sb, Si, Sn, Sr, Ta, Ti, V, W, Y, Zn, and Zr) using a single-sample quantitative emission spectrographic method (Grimes and Mazzanico, 1968). Because of the limited amount of sample material, the concentrate samples were only analyzed spectrographically. The stream-sediment samples were also analyzed for arsenic by colorimetry (Mead and others, 1983), for zinc, antimony, and gold by atomic-absorption spectrometry (Mead and others, 1986), for lead, copper, and silver by atomic absorption spectrometry (Viest, 1978). Analyses for both sample types were performed partly in the field in a mobile chemistry laboratory and partly in U.S. Geological Survey laboratories near Golden, Colorado.

The spectrographic analyses of elements are reported as the appropriate geometric midpoints (0.15, 0.2, 0.3, 0.5, 0.7, and 1.0, or appropriate powers of ten of these values) of concentrations whose respective bounds are 0.12, 0.18, 0.26, 0.38, 0.56, 0.93, and 1.2 (or appropriate powers of ten of these values). In general, the precision of the spectrographic method is

plus or minus one reporting value of the value given by the analyst approximately 83 percent of the time and plus or minus two reporting values of the value given by the analyst 95 percent of the time (Moloch and Grimes, 1976). A reference standard sample was analyzed with each batch of field samples to monitor the quality of the analyses.

For the six elements analyzed by colorimetry or atomic-absorption spectrometry, the reporting values vary with the element and with the concentration level for any given element. Precision for these analytical methods is commonly reported as a percent relative standard deviation and is based on replicate analyses of samples selected to provide information at different concentration levels. In general, the precision for each method tends to be lowest for those samples containing a given element at or near its lower limit of determination. For the six elements discussed in the geochemical chapters in this folio, the reported ranges of percent relative standard deviation (RSD) are as follows:

Element	Range of percent RSD	Source of data
As	0.0-48.5	Unpublished analyses by R. H. Hill, 1981
Zn	3.4-30.2	Mead and others, 1983, p. 21
Sb	3.7-10.7	Welch and Chao, 1975
Ag	0.0-1.0	Mead, 1980
Bi	3.3-18.8	Viest, 1978
Cd	1.4-4.0	Viest, 1978

As an example to use in interpreting these ranges, one might consider antimony, whose range is shown as 3.7-10.7 percent RSD. This range indicates that a reported antimony value should be within ± 10.7 percent (usually much less) of the mean value for that sample.

EVALUATION OF THE CHEMICAL ANALYSES

Of the 37 elements determined in the stream-sediment samples, 12 elements (Ag, As, Au, Bi, Cd, Co, Cu, Fe, La, Mg, Mn, Mo, Pb, Sb, Si, Sn, Sr, Ta, Ti, V, W, Y, Zn, and Zr) were most likely to be associated with hydrothermal alteration and (or) mineralization of the types known or thought to exist in the Walker Lake quadrangle. The chemical analyses for these individual selected elements have been plotted on maps in other chapters of this folio (Chaffee and others, 1988a, b). In this chapter these same elements have been grouped and evaluated using a technique called SCORESUM.

The Walker Lake quadrangle contains a wide variety of known or suspected mineral deposits. Many ore-related elements seem to be associated with more than one type of mineral deposit; consequently, the task of sorting out deposit types using element associations is not entirely successful. In the Walker Lake quadrangle, the SCORESUM technique was developed to provide a means of plotting and evaluating information on selected groups of elements on a single map. SCORESUM is able to utilize elements that may only have a very small percentage of the samples with reported values above the lower limit of analytical determination. SCORESUM can also be used to normalize the chemical effects of lithology resulting from including in one data set samples from areas containing chemically different rock types.

The SCORESUM maps were created in the following manner. First, all of the analyses for the twelve selected elements in the stream-sediment samples were separated into three subsets based on the estimated relative volume percentages, as observed in the active alluvium at each sample site, of the three major rock divisions in the quadrangle (Paleozoic and Mesozoic rocks, Mesozoic intrusive rocks, and Tertiary volcanic rocks). Threshold values (highest background values) were assigned to each element in each subset after a study of the respective frequency-distribution histograms. The full range of reported analyses for each element of interest in each subset was next divided into four categories. Anomaly scores of 1 (weakly anomalous), 2 (moderately anomalous), or 3 (strongly anomalous)—were substituted for all of the analyses falling into each of the four categories. For a given element, the range of reported analyses falling into each of the three anomaly categories was somewhat arbitrarily selected. As a rough guide, the concentrations assigned to the weakly anomalous category generally included those values between the threshold value and the 95th percentile value for the entire data subset. Those concentrations considered to be moderately anomalous generally fell between the 95th and 98th percentiles, and those concentrations considered to be strongly anomalous were generally restricted to the upper 2 percent of the samples in the entire data subset.

After the anomaly scores were assigned to all of the selected elements, the three subsets were merged into one analytical data set. For each SCORESUM map included in this chapter, a group of elements known or suspected to be associated with altered or mineralized areas was selected for study, and the anomaly scores for this group of elements were summed for each sample site (SCORESUM) and then plotted on a map.

The SCORESUM values created for each map were ranked in order from lowest to highest. For plotting purposes these values were then separated into five classes, at the whole numbers nearest to the 85th, 95th, 98th, and 99th percentiles. The areal distributions of the drainage basins associated with these anomalous samples were then compared to known geological conditions and to the locations of known or suspected mineral deposits, and a SCORESUM threshold value that was considered to best fit the known conditions was selected.

DISCUSSION OF THE MAPS

Maps A and B show the distributions of SCORESUM anomalies for two different suites of elements determined in samples of stream sediment. Map A, here called the geochemical anomaly map, shows the first suite, which consists of all 12 of the elements considered to be related to hydrothermal mineral deposits (Ag, As, Au, Bi, Cd, Co, Cu, Fe, La, Mg, Mn, Mo, Pb, Sb, Si, Sn, Sr, Ta, Ti, V, W, Y, Zn, and Zr). All mineralized sites and areas in the Walker Lake quadrangle are compared on this map, without regard to specific deposit types, and have been ranked by the SCORESUM technique. (1) The southern Pine Nut Mountains, (B) the Monitor district and the area north of Leavitt Peak, (C) the southern part of the Wellington Hills, (D) the Silverado district in the Sweetwater Mountains, (E) the area between the upper West Walker River and Twin Lakes in the Sierra Nevada, (F) an area northeast of Mount Grant and west of Walker Lake in the central Wassuk Mountains, (H) the area north of Jim Canyon in the southern Wassuk Mountains, (I) the area between Huntington Valley and Teels Marsh, (J) an area south and west of Teels Marsh near Jack Spring Canyon, (K) an area east of Hill Mountain in the southeastern corner of two mountain ranges in the south of Gap Douglas and Thunder Mountain in the eastern Excelsior Mountains, and (M) the western Pilot Mountains, and (N) the northeastern part of the Garfield Hills.

Most of the anomalies described above are associated either with the Paleozoic and Mesozoic rocks—generally where they are near to outcrops of Mesozoic intrusive rocks—or with the Tertiary volcanic rocks. The first two are particularly permeative for contamination of the samples by base and precious metals; both environments are permissive for leakage aureoles associated with concealed porphyry molybdenum deposits.

Most of the anomalies identified above are shown on maps in this chapter of the folio. Unlike all of the other elements, gold was determined in only 127 out of the 1,116 samples analyzed.

For all of the maps in this chapter of the folio there is no assurance that all of the anomalies identified above are identical to the anomalies in all of the deposits in the categories thought to be represented by each map have in fact been identified. It is recommended that all of the maps in the entire folio be consulted as a part of any decision-making process.

localities in the upper West Walker River area in the Sierra Nevada (weak base metals); (G) the area between Eagle Creek and Lundy Canyon in the Sierra Nevada (base and precious metals); (H) the area north of Jim Canyon in the southern Wassuk Mountains (base and precious metals, tungsten, molybdenum); (I) the south-central Excelsior Mountains north of Marlette (base and precious metals); (J) the large area encompassing the western Pilot Mountains, the eastern Excelsior Mountains, and the area extending southwest from these two ranges to the southeastern corner of the Walker Lake quadrangle (base and precious metals; contact-metamorphic tuffaceous); and (K) the Knappton Gabbro Valley Range (disseminated gold, base and precious metals, porphyry copper, contact-metamorphic tuffaceous). All of the sites shown by a symbol other than a "+" on map A reflect at least two anomalous elements; clearly, other drainage basins associated with sites or areas not listed above may also contain favorable, although relatively less important, mineralized areas.

The suite of elements shown on map B (Ag, As, Au, Bi, Cd, and Sb) is considered to be a favorable element suite for identifying pre-Cretaceous vein deposits, disseminated gold deposits, and silver-associated base-metal deposits. Samples with a SCORESUM value of 3 or more (the upper 11 percent of all of the samples in the data set) have been arbitrarily chosen as anomalous for this map. The SCORESUM technique, as identified by the SCORESUM technique, are (A) the Monitor district including the area north of Leavitt Peak, (B) the Buckskin area west of Terrington, (C) the area at the southeast end of the Pine Nut Mountains, (D) the area in the east-central part of the Wellington Hills, (E) the Pine Grove district in the Pine Grove Hills, (F) the Silverado district in the Sweetwater Mountains, (G) the area north and west of the Masonic district, (H) the Bush Mountain area northeast of Bridgeport Nevada, (I) the Cherry Creek upper West Walker River area in the Sierra Nevada, (J) the Eagle Creek area west of Bridgeport valley, (K) the Dry Creek-Lundy Canyon-Conway Summit area northwest of Mono Lake, (L) the Bodie-Aurora area and the associated Rough Creek drainage basin, (M) the area north of Jim Canyon in the southern Wassuk Mountains, (N) the south-central Excelsior Mountains near Marlette, (O) the Garfield Hills, (P) the area south of the Garfield Hills and the southern Gabbro Valley Range, (Q) the eastern Excelsior Mountains-western Pilot Mountains area, (R) the eastern Excelsior Hills-southern Gabbro Valley Range area, (S) the Wilkerson Canyon area in the northern Gabbro Valley Range, and (T) the area south of and draining the Ramble district, which is just north of the northern border of the Walker Lake quadrangle. Site (O) is a highly significant anomaly in the area of the old Candalaria hill site at Belleville. The anomaly at site (T) may also represent contamination from tailings from ores that were milled in the Ramble district but mined elsewhere.

Most of the significant anomalies listed above are associated either with the Paleozoic and Mesozoic rocks or with the Tertiary volcanic rocks. Sites M, L, J, and K are located in Mesozoic intrusive rocks, but the anomalies are associated with the Paleozoic and Mesozoic rocks.

Maps C and D show the distributions of SCORESUM anomalies for two additional suites of elements analyzed in samples of stream sediment. The suite shown on map C consists of the elements silver, arsenic, gold, bismuth, cadmium, copper, lead, antimony, zinc, and tin. This suite is considered to be the most favorable to use to identify areas containing complex base- and pre-Cretaceous deposits of all types and perhaps also environments favorable for porphyry copper deposits.

Samples with a SCORESUM value of 4 or more (the upper 11 percent of all of the samples in the data set) are considered to be anomalous for this map. The most significant areas, as identified by the SCORESUM technique, are (A) the Monitor district and the area to the north of Leavitt Peak, (B) the Buckskin area west of Terrington, (C) the east-central part of the Wellington Hills and the area directly across the Smith Valley in the eastern Pine Grove Hills, (D) the Silverado district in the Sweetwater Mountains, (E) the area between the upper West Walker River and Twin Lakes in the Sierra Nevada, (F) an area northeast of Mount Grant and west of Walker Lake in the central Wassuk Mountains, (H) the area north of Jim Canyon in the southern Wassuk Mountains, (I) the area between Huntington Valley and Teels Marsh, (J) an area south and west of Teels Marsh near Jack Spring Canyon, (K) an area east of Hill Mountain in the southeastern corner of two mountain ranges in the south of Gap Douglas and Thunder Mountain in the eastern Excelsior Mountains, and (M) the western Pilot Mountains, and (N) the northeastern part of the Garfield Hills.

Most of the anomalies described above are associated either with the Paleozoic and Mesozoic rocks—generally where they are near to outcrops of Mesozoic intrusive rocks—or with the Tertiary volcanic rocks. The first two are particularly permeative for contamination of the samples by base- and precious-metal deposits.

Map A is restricted to the elements bismuth, molybdenum, and tungsten. This suite seems to be the best to use to identify areas favorable for contact-metamorphic tungsten deposits and possibly concealed porphyry molybdenum deposits. Samples with a SCORESUM value of 3 or more (the upper 5 percent of all of the samples in the data set) have been arbitrarily chosen as anomalous for this map. The SCORESUM technique, as identified by the SCORESUM technique, are (A) the southern Pine Nut Mountains, (B) the Monitor district and the area north of Leavitt Peak, (C) the southern part of the Wellington Hills, (D) the Silverado district in the Sweetwater Mountains, (E) an area between the upper West Walker River and Twin Lakes in the Sierra Nevada, (F) an area northeast of Mount Grant and west of Walker Lake in the central Wassuk Mountains, (H) the area north of Jim Canyon in the southern Wassuk Mountains, (I) the area between Huntington Valley and Teels Marsh, (J) an area south and west of Teels Marsh near Jack Spring Canyon, (K) an area east of Hill Mountain in the southeastern corner of two mountain ranges in the south of Gap Douglas and Thunder Mountain in the eastern Excelsior Mountains, and (M) the western Pilot Mountains, and (N) the northeastern part of the Garfield Hills.

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Most of the anomalies identified above are shown on maps in this chapter of the folio. Unlike all of the other elements, gold was determined in only 127 out of the 1,116 samples analyzed.

For all of the maps in this chapter of the folio there is no assurance that all of the anomalies identified above are identical to the anomalies in all of the deposits in the categories thought to be represented by each map have in fact been identified. It is recommended that all of the maps in the entire folio be consulted as a part of any decision-making process.

MAPS SHOWING DISTRIBUTION OF ANOMALIES BASED ON THE USE OF SCORESUM PLOTS FOR SELECTED GROUPINGS OF ELEMENTS IN SAMPLES OF MINUS-60-MESH (0.25-MM) STREAM SEDIMENT, WALKER LAKE 1° X 2° QUADRANGLE, CALIFORNIA AND NEVADA

By
MA Chaffee
1988

NATION—GEOLOGICAL SURVEY, WASHINGTON

The Walker Lake 1° x 2° Quadrangle Geologic Map, 1:62,500 scale, is available in hard copy form for \$20.00. Contact: National Technical Information Service, Springfield, VA 22161.

best copy available

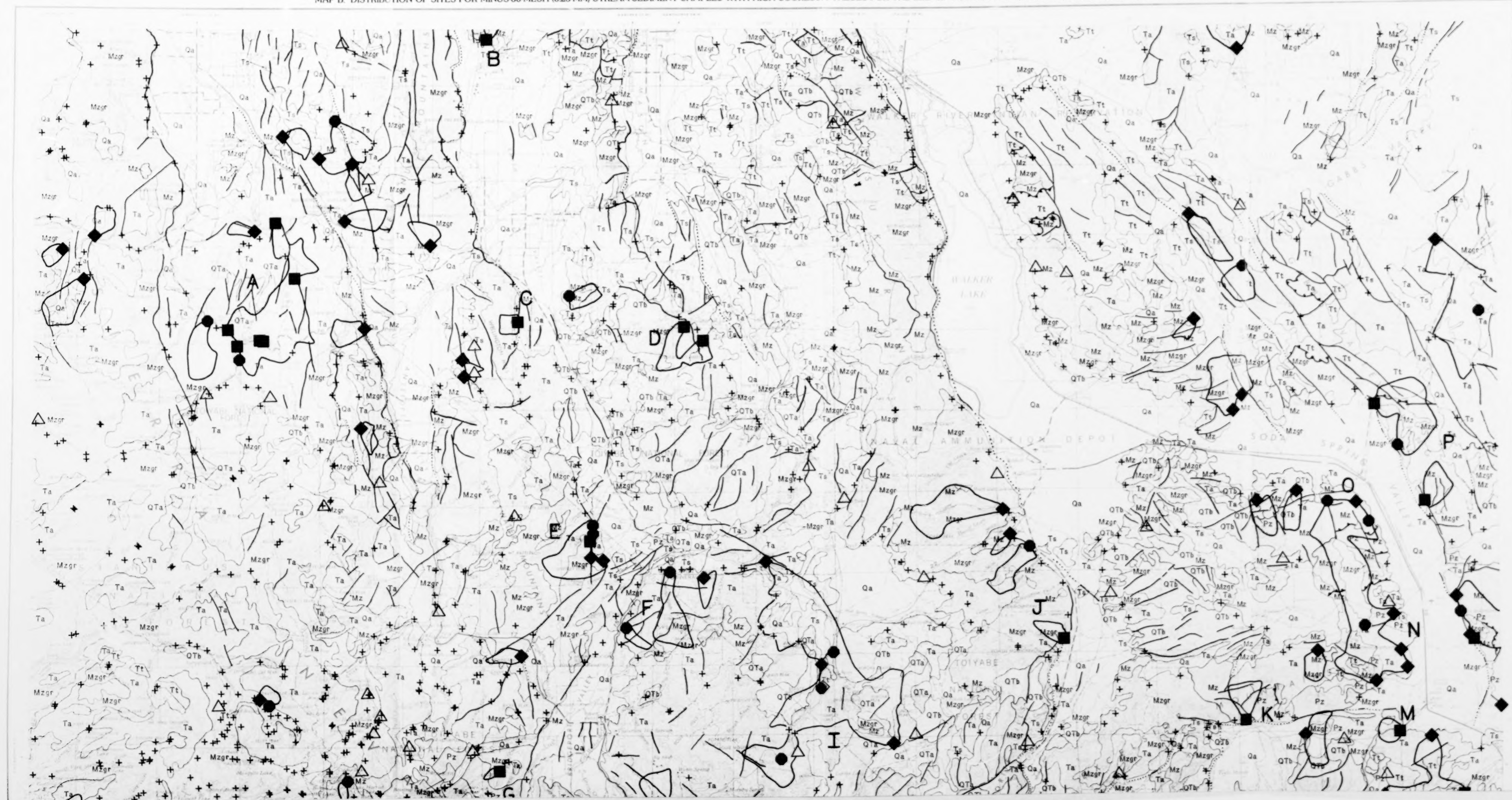


MAP B. DISTRIBUTION OF SITES FOR MINUS 60 MESH (0.25 MM) STREAM SEDIMENT SAMPLES WITH HIGH SCORESUM VALUES FOR THE ELEMENT SUITE SILVER, ARSENIC, GOLD, BISMUTH, AND ANTIMONY

EXPLANATION

○ SAMPLE LOCALITY AND BOUNDARY OF ANOMALOUS AREA FOR ONE OR MORE ELEMENTS AT CENTER OF PLATED SYMBOL: 5, upper 25 of the data (90th percentile); 30, diamond, next 30; 10, triangle symbol (+), remaining 10% (for most significant sample sites).

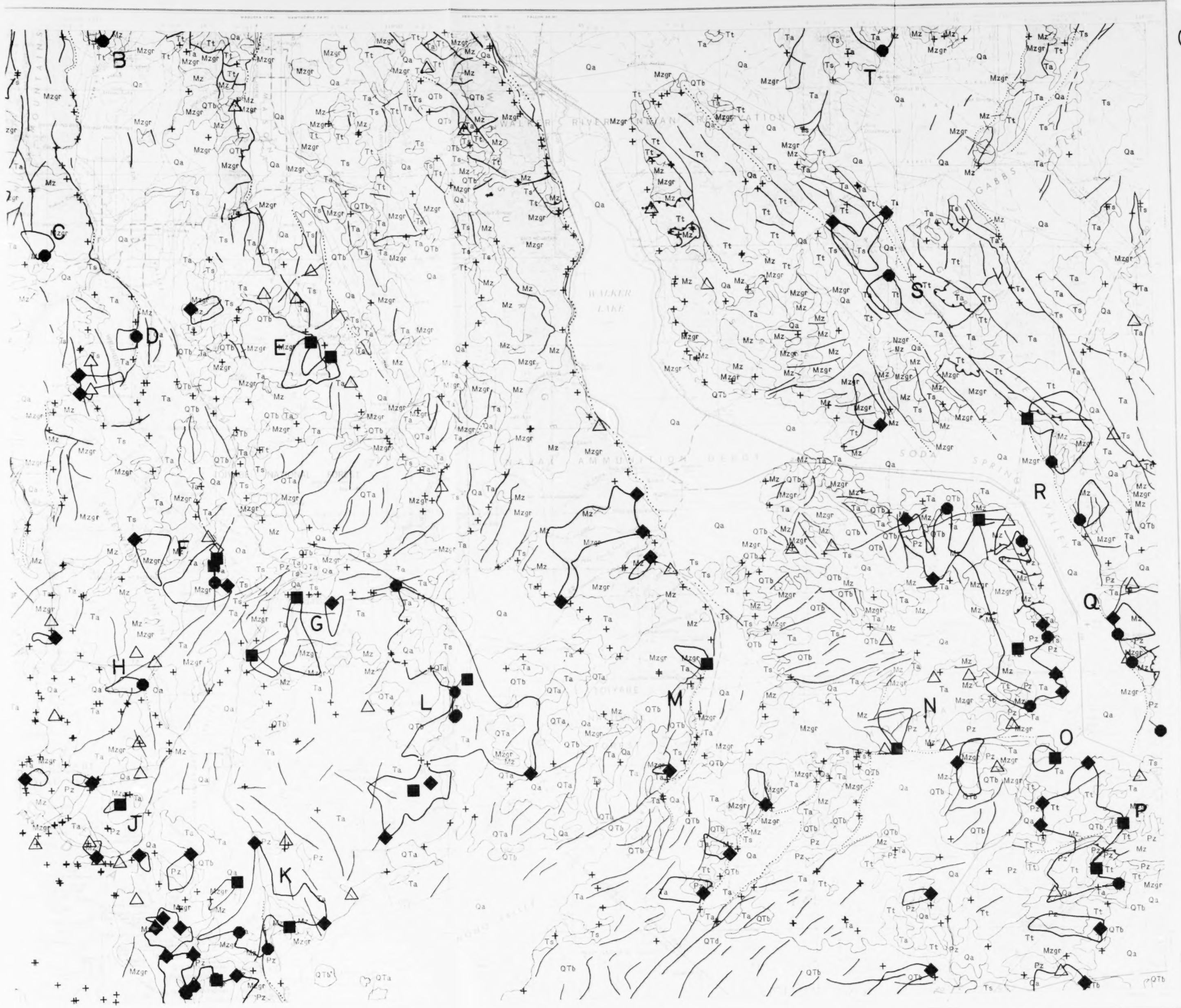
S SIGNIFICANT ANOMALOUS AREA OF 1:1 IN 1041



EXPLANATION

○ SAMPLE LOCALITY AND BOUNDARY OF ANOMALOUS AREA FOR TWO OR MORE ELEMENTS AT CENTER OF PLATED SYMBOL: 5, upper 25 of the data (90th percentile); 30, diamond, next 30; 10, triangle symbol (+), remaining 10% (for most significant sample sites).

N SIGNIFICANT ANOMALOUS AREA OF 1:1 IN 1041

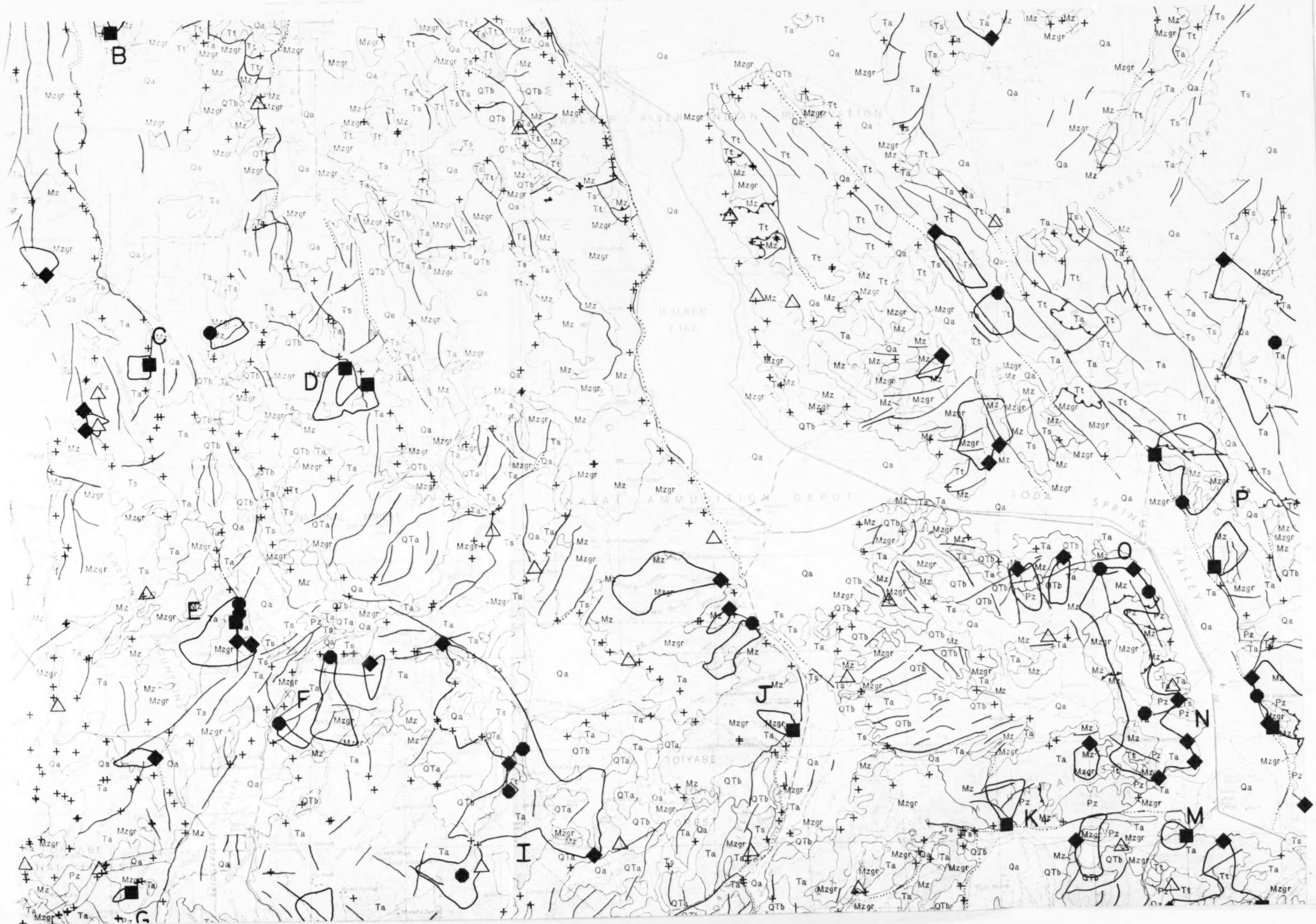


EXPLANATION

○ SAMPLE LOCALITY AND BOUNDARY OF ASSOCIATED DRAINAGE BASIN. Anomalous for one or more selected elements. Locality is at center of plotted symbol. Square symbol indicates upper 25 of the data (90th percentile). Circle symbol is next 25; diamond, next 25; triangle, next 25; and plus symbol (+), remaining 25%. Dashed symbols identify the most significant sample sites.

S SIGNIFICANT ANOMALOUS AREA OR SITE—letter is keyed to list in text.

ION OF SITES FOR MINUS 60 MESH (0.25 MM) STREAM SEDIMENT SAMPLES WITH HIGH SCORES IN VALUES FOR THE ELEMENT SUITE SILVER, ARSENIC, GOLD, BISMUTH, AND ANTIMONY



EXPLANATION

○ SAMPLE LOCALITY AND BOUNDARY OF ASSOCIATED DRAINAGE BASIN. Anomalous for one or more selected elements. Locality is at center of plotted symbol. Square symbol indicates upper 25 of the data (90th percentile). Circle symbol is next 25; diamond, next 25; triangle, next 25; and plus symbol (+), remaining 25%. Dashed symbols identify the most significant sample sites.

N SIGNIFICANT ANOMALOUS AREA OR SITE—letter is keyed to list in text.

Notes: The following correlation and description of map units are for the geologic base map shown in gray.

CORRELATION OF MAP UNITS	
Qa	QUATERNARY
Qta	QUATERNARY
Qtb	QUATERNARY
Ta	TERTIARY
Ts	TERTIARY
Mzgr	MESOZOIC
Pz	PALEOZOIC

DESCRIPTION OF MAP UNITS

Qa ALLUVIAL, LACUSTRINE, EOLIAN, LANDSLIDE, AND GLACIAL DEPOSITS, UNDIVIDED (QUATERNARY)—As mapped locally includes uppermost tertiary gravel (QUATERNARY AND TERTIARY)—ranges in age from about 9 m.y. to less than 1 m.y.

Qta ANDESITE TO RHYOLITE (QUATERNARY AND TERTIARY)—Andesite flows and breccia. Minor rhyolite flows and shallow intrusive rocks. Ranges in age from about 9 m.y. to less than 1 m.y.

Qtb ANDESITE TO RHYOLITE (QUATERNARY AND TERTIARY)—Andesite flows and breccia. Minor rhyolite flows and shallow intrusive rocks. Ranges in age from about 9 m.y. to less than 1 m.y.

Ta ANDESITE TO RHYOLITE (TERTIARY)—Andesite flows and breccia. Minor rhyolite flows and shallow intrusive rocks. Ranges in age from about 22 m.y. to 5 m.y.

Ts TUFF (TERTIARY)—Welded and nonwelded rhyolite ash-flow tuff. Minor rhyolite flows and shallow intrusive rocks, andesite flows, and sedimentary rocks sparse basalt. Includes some intrusive rocks. Ranges in age from 30 m.y. to 22 m.y.

Mzgr GABRIOLIC AND FELSIC INTRUSIVE ROCKS

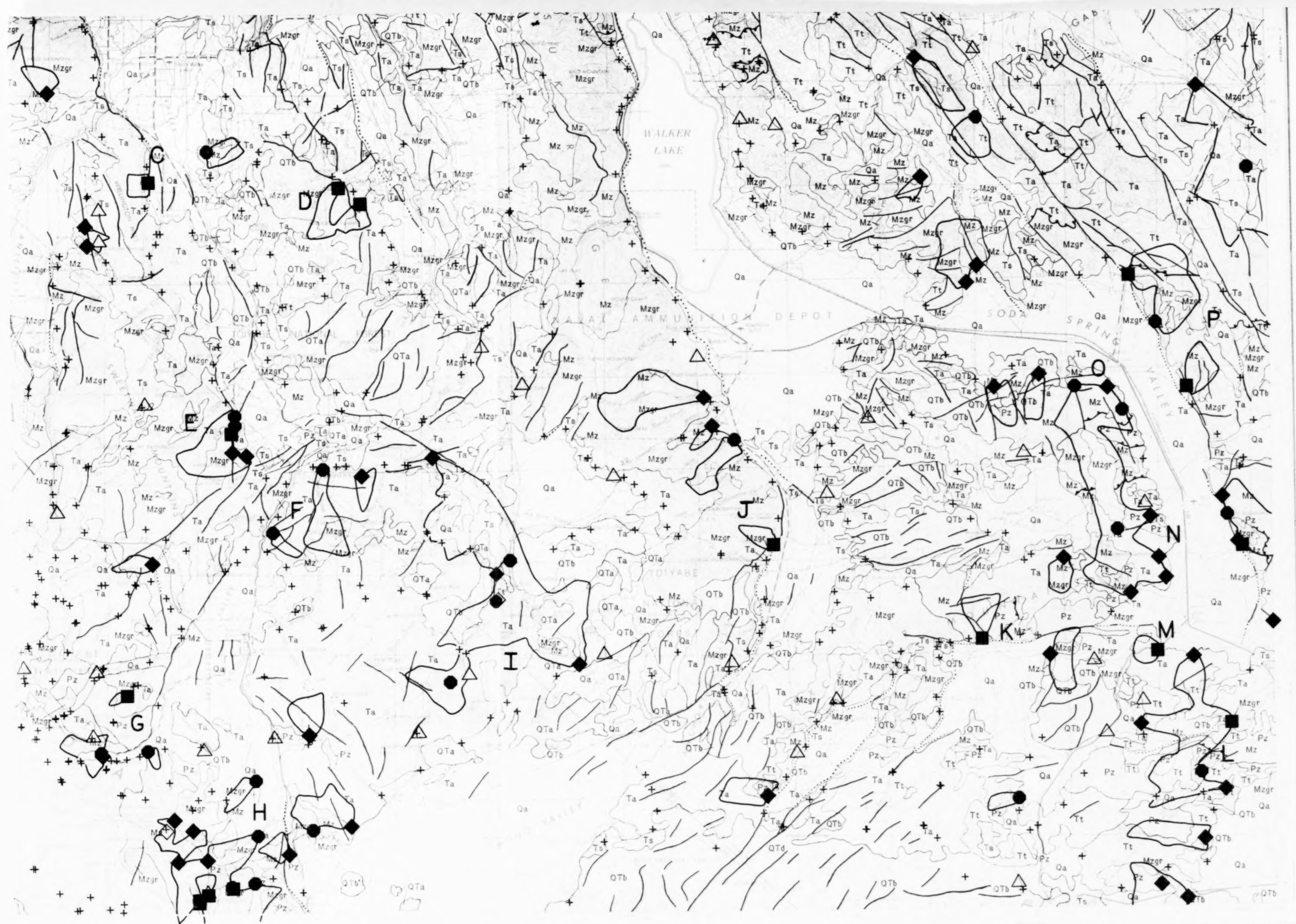
Pz VOLCANIC AND SEDIMENTARY ROCKS, UNDIVIDED (MESOZOIC)—Andesite to rhyolite lava flows, breccia, tuff, volcanic sandstone, and conglomerate; shallow marine siltstone, sandstone, conglomerate, and limestone continental.



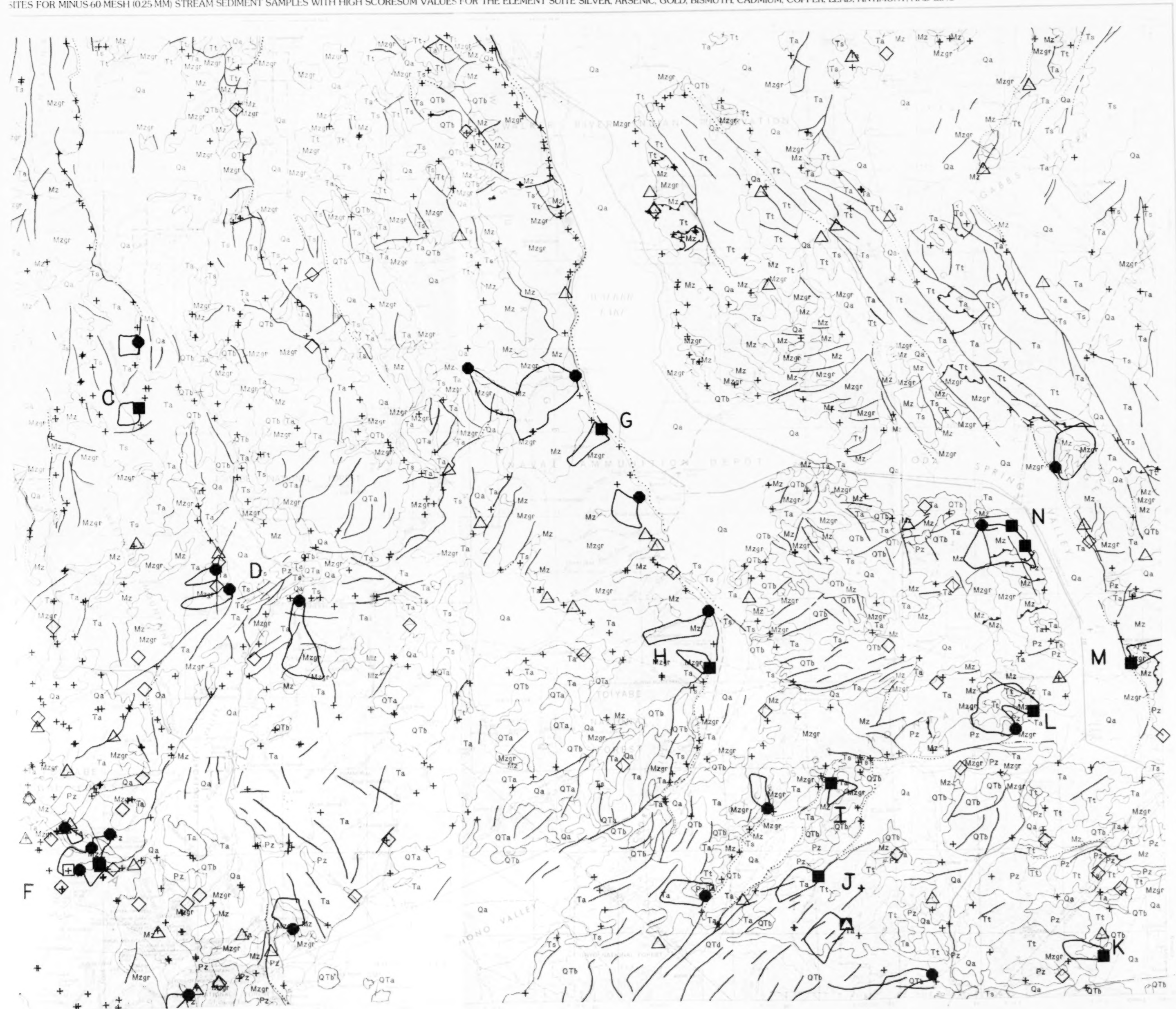
MAP C. DISTRIBUTION OF SITES FOR MINUS 60 MESH (0.25 MM) STREAM SEDIMENT SAMPLES WITH HIGH SCORES/UM VALUES FOR THE ELEMENT SUITE SILVER, ARSENIC, GOLD, BISMUTH, CADMIUM, COPPER, LEAD, ANTIMONY, AND ZINC



MAPS SHOWING DIS
SCORESUM PLO1
SAMPLES OF 1
WALKER LAKE 1



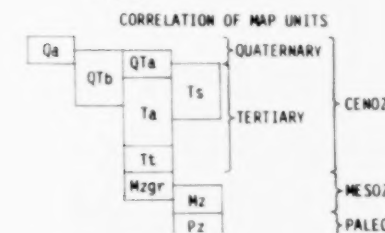
SITES FOR MINUS 60 MESH (0.25-MM) STREAM SEDIMENT SAMPLES WITH HIGH SCORESUM VALUES FOR THE ELEMENT SUITE SILVER, ARSENIC, GOLD, BISMUTH, CADMIUM, COPPER, LEAD, ANTIMONY, AND ZINC



DISTRIBUTION OF SITES FOR MINUS 60-MESH (0.25-MM) STREAM SEDIMENT SAMPLES WITH HIGH SCORESUM VALUES FOR THE ELEMENT SUITE BISMUTH, MOLYBDENUM, AND TUNGSTEN

Geology simplified from Stewart and others, 1982

Note: The following correlation and description of map units are for the geologic base map shown in gray.



DESCRIPTION OF MAP UNITS

- Qa Alluvial, lacustrine, eolian, landslide, and glacial deposits, undivided (Quaternary). As mapped locally includes uppermost Tertiary gravel.
- Qb Bluff (Quaternary and Tertiary). Ranges in age from about 9 m.y. to less than 1 m.y.
- Qc Andesite to rhyolite (Quaternary and Tertiary). Andesite flows and breccia. Minor rhyolitic flows and shallow intrusive rocks. Ranges in age from about 5 m.y. to less than 1 m.y.
- Qd Sedimentary rocks (Tertiary). Buffaceous sandstone, siltstone, and conglomerate to gravel. Minor tuff and volcanic breccia. Ranges in age from about 12 m.y. to 2 m.y.
- Qe Andesite to rhyolite (Tertiary). Andesite flows and breccia. Minor rhyolitic flows and shallow intrusive rocks, tuffaceous to rhyolitic ash-flow tuffs, and sedimentary rocks; sparse basalt; includes some intrusive rocks. Ranges in age from about 22 m.y. to 5 m.y.
- Qf Tuff (Tertiary). Welded and nonwelded rhyolitic ash-flow tuff. Minor rhyolite flows and shallow intrusive rocks, andesite flows, and sedimentary rocks; sparse basalt; includes some intrusive rocks. Ranges in age from 30 m.y. to 22 m.y.
- Mzgr Granitic rocks (Mesozoic). Granite to granodiorite. Minor dioritic, gabbroic, and felsic intrusive rocks.
- Mz Volcanic and sedimentary rocks, undivided (Mesozoic). Andesitic to rhyolitic lava flows, breccia, tuff, volcanic sandstone, and conglomerate; shallow marine siltstone, sandstone, conglomerate, and thin-bedded continental sandstone and conglomerate. Metamorphosed near granitic rocks.
- Pz Sedimentary and volcanic rocks, undivided (Paleozoic). Deep-water marine chert, phyllite, shale, carbonate rocks, volcanogenic turbidite, sandstone, and conglomerate (Ordovician, Devonian, Pennsylvanian, and Permian); shallow-water siltstone, sandstone, conglomerate, and carbonate (Cambrian, Mississippian, and Permian) as mapped includes upper Proterozoic rocks at one locality; and andesitic breccia and lava (Permian). Metamorphosed near granitic rocks.

- GEOLOGIC CONTACT
- HIGH-ANGLE FAULT—Dotted where concealed
- THRUST OR LOW-ANGLE FAULT

EXPLANATION

- SAMPLE LOCALITY AND BOUNDARY OF ASSOCIATED DRIFTING ROSE—Known for one or more selected elements. Locality is at center of plotted symbol. Square symbol indicates upper 25 of the data (50th percentile). Circle symbol is next 35; diamond, next 55; triangle, next 75; and plus symbol (+), remaining 85%. Dashed symbols identify the most significant sample sites.
- M SIGNIFICANT ANOMALOUS AREA OR SITE—Letter is keyed to list in text.



SCALE 1:250,000

CONTOUR INTERVAL 200 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1989

MAPS SHOWING DISTRIBUTION OF ANOMALIES BASED ON THE USE OF SCORESUM PLOTS FOR SELECTED GROUPINGS OF ELEMENTS IN SAMPLES OF MINUS-60-MESH (0.25-MM) STREAM SEDIMENT, WALKER LAKE 1° X 2° QUADRANGLE, CALIFORNIA AND NEVADA

By
MA Chaffee
1988

NOTES: GEOLOGICAL SURVEY, WASHINGTON, 1984
Revised by U.S. Geological Survey, Washington, D.C. 20508, under license from the U.S. Geological Survey, 1982.